

A Brief History of *Bacillus anthracis*

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Bacillus anthracis (anthrax) made its first recorded appearance in 1491 B.C. in the early writings of Mesopotamia and the Book of Genesis. The Old Testament description of the 5th and 6th Egyptian plagues showed typical symptoms of anthrax. Before Virgil (70 B.C.-19 B.C.) composed the *Aeneid*, he wrote a selection of poems on agriculture called *Georgics*. Aside from topics of animal husbandry and veterinary medicine in his third *Georgic*, he dedicates a section to a disease that manifests itself in sheep, cattle, horses, and wild animals. Sparse comments on anthrax are also described in early Hindi and Greek literature. The infamous “Black Bane” occurred in 1613 and became the first European pandemic. It caused over 60,000 deaths in humans and cattle. *Bacillus anthracis* is derived from the Greek, *anthracites*, which means coal, referring to the black, coal-like lesions that are commonly found on the skin of those infected.

The first microbiological breakthrough was made by Pierre Rayer (1793-1867) and Casimir-Joseph Davaine (1812-1882) in 1850 when they identified small rods, about half the length of a red blood corpuscle, in the blood of anthrax infected sheep. Davaine suggested that the “corpuscles” were the etiology of anthrax, although his hypothesis was not verified for many years. However, several people contracted experimental anthrax through inoculation of the diseased blood but were not successful in showing the corpuscles in the blood. There was also no explanation as to how anthrax could be transmitted through air when it originated from spores in soil.

In 1876, an epidemic of farm animals with anthrax stimulated Robert Koch (1843-1910), to search for the cause. He first used slivers of wood to inoculate healthy mice by their tails with splenic tissue from an infected cow. He did this with a number of mice in series, using the previously dead mouse as the source for the next. All the healthy mice died and each mouse’s “spleen was markedly swollen and contained a large number of [rods]...similar in appearance [and] immotile and without spores”(1). Having shown that the rods “possess the ability to reform bacteria,”(1) he performed the experiment once more, but this time, with healthy mice inoculated with blood from healthy animals. All these mice survived, confirming that the disease is transmitted through the bacilli in

the blood of anthrax victims and can be transmitted from one host to another. Koch performed another experiment by growing pure cultures of rods from the aqueous humor of an ox's eye. Through watching the bacilli, he noted that when environmental conditions are unfavorable, especially under conditions of oxygen deprivation, they produced rounded spores within themselves. This proved to be a self-protective mechanism; when growth conditions are more favorable, the spores then return to forming bacilli. Thus, *Bacillus anthracis* could still cause anthrax even without direct animal contact via contact with the spores (1).

These experiments were a major step towards formulating the postulates of causation of infectious diseases which now bears his name. As Koch's rival, Louis Pasteur (1822-1895), was not convinced that Koch's work was sufficient in explaining disease transmission. In 1881, he vaccinated two different groups of cattle with the virulent *Bacillus anthracis* strain; one group was treated with his vaccine while the control group was not. When all the vaccinated animals survived and the others died, Pasteur had further proof that the organism *Bacillus anthracis* causes anthrax. Though each used a different method, both men verified the germ theory of disease.

Although the CDC published a review in 1980 stating that the western medical community viewed inhalational anthrax as "primarily of historical interest," (6) inhalational anthrax has reappeared in the guise of biological warfare. The Sverdlovsk Epidemic was an accidental anthrax outbreak near Moscow in 1979 where many individuals suffered gastrointestinal, cutaneous, and inhalational anthrax linked to secret biological weapons activity at a nearby military compound (9). In 1993, an aerosol containing *Bacillus anthracis* was released from a cooling tower of the Aum Shinrikyo headquarters building in Kameido, Tokyo. Nobody died, but many neighborhood residents complained of foul odors, appetite loss, nausea, and vomiting (7). Pre and post the September 11, 2001 incident, anthrax spores in powder form were sent to Senator Patrick Leahy, Senator Tom Daschle, NBC news anchor Tom Brokaw, and the New York Post. Some employees who handled the letter contracted inhalational anthrax or the skin form of anthrax; a number became sick and a few died (Figure1).



Figure 1: Anthrax contaminated mail sent from terrorists to Leahy, Daschale, Brokaw, and the NY Post (8)

References

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